LAID-OPEN PATENT GAZETTE

Laid-Open No. 99-137592

Laid-Open Date: May 25, 1999

Examination: Unrequested

Application No. 97-308946

Filing Date: November 11, 1997

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[Title of the invention] Lenticular capsule front plug

[Abstract]

[Task] To provide a lenticular capsule front plug for allowing a filler to be easily injected without loading to the ophthalmic tissue and the tube and plug member of the lenticular capsule front plug, when inserting the lenticular capsule front plug into the eye or installing it at the incision of the lenticular capsule front, to solve the problems caused by such loading, and without allowing the tube to be bent when inserting it into the eye.

[Solving means] A lenticular capsule front plug 10, which consists of a tube 12 for injecting a light transmitting filler into a lenticular capsule and a plug member 14 to be installed to close the incision of the lenticular capsule front, characterized in that the tube 12 is inserted through and fixed in the plug member 14, with the tube 12 kept

inclined against the plug member 14 at an angle of 1 to 45 degrees.

[Claims]

[Claim 1] A lenticular capsule front plug, which consists of a tube for injecting a light transmitting filler into a lenticular capsule emptied by taking out the contents from an incision formed in the lenticular capsule front, and a plug member to be fixed to the tube, with the tip portion of the tube inserted through the plug member, and to be fitted in the incision to close the incision, characterized in that

the tube is inserted through and fixed in the plug member, with the tube kept inclined against the reference (standard) plane of the plug member at an angle of 1 to 45 degrees.

[Claim 2] A lenticular capsule front plug, according to claim 1, wherein a check means for preventing the back flow of the filler injected through the hollow portion of the tube, for preventing the filler from flowing out is provided in the tube.

[Claim 3] A lenticular capsule front plug, according to claim 1 or 2, wherein a protrusion extending sideways is provided integrally at the peripheral portion of the plug member, so that the plug member can be fitted into the incision while being guided by the protrusion.

[Claim 4] A lenticular capsule front plug, according to any one of claims 1 through 3, wherein a circumferential groove opened sideways is formed around the full circumference at the peripheral portion of the plug member, so that the circumferential portion of the incision may be fitted in the

circumferential groove, to allow the plug member to be fitted in the incision.

[Claim 5] A lenticular capsule front plug, according to claim 1 or 2, wherein a protrusion extending sideways is provided integrally at the peripheral portion of the plug member, and a circumferential groove opened sideways is formed around the full circumference at the peripheral portion of the plug member, in such a manner that the protrusion is positioned on the tube tip side in reference to the circumferential groove, so that when the plug member is installed, the circumferential portion of the incision may be fitted in the circumferential groove and that the protrusion may be positioned in the lenticular capsule.

[Claim 6] A lenticular capsule front plug, according to claim 4 or 5, wherein the peripheral portions of the plug member existing on both sides of the circumferential groove in the through direction of the tube are formed in such a manner that the peripheral portion on the tube tip side has a flat area larger than that of the peripheral portion on the tube base side.

[Claim 7] A lenticular capsule front plug, according to any one of claims 1 through 6, wherein the protrusion is provided at a shifting angle of 60 to 120 degrees on either side, with the tube-through portion of the plug member, made into ~~as~~ the center in reference to the tube extending direction on the projected plan view.

[Claim 8] A lenticular capsule front plug, according to any one of claims 1 through 7, wherein the circumferential groove is formed to have a V groove structure.

[Claim 9] A lenticular capsule front plug, according to any one of claims 1 through 8, wherein the plug member is made of a soft material.

[Claim 10] A lenticular capsule front plug, according to any one of claims 1 through 9, wherein the plug member is composed of two sheets with a gel provided between the sheets.

[Claim 11] A lenticular capsule front plug, according to claim 10, wherein the protrusion extending sideways is integrally provided at the peripheral portion of the sheet positioned on the tube tip side, ~~among~~ out of the two sheets constituting the plug member, so that when the plug member is installed, the sheet having the protrusion may be positioned in the lenticular capsule.

[Detailed description of the invention]

[0001]

[Technical field] The present invention relates to a lenticular capsule front plug, viz. an ophthalmic operation tool used for injecting a predetermined filler into a lenticular capsule from an incision in the lenticular capsule front after the contents (nuclei, cortical substance, epithelial cells, etc.) of the crystalline lens cloudy because of cataract, etc. has been sucked and removed from the incision. Concretely, it relates to a lenticular capsule front plug for injecting a filler such as a silicone gel into a lenticular capsule through a tube, in order to give a crystalline lens function, while preventing the filler from flowing out while the filler is being injected and after the filler has been injected.

[0002]

[Background art] It has been being done to insert an intraocular implant or inject a light-transmittable filler into the lenticular capsule after removing the contents (nuclei, cortical substance, epithelial cells, etc.) of the crystalline lens by operation for treating cataract, etc. It is known that the latter method of injecting a predetermined filler into the lenticular capsule does not have such a problem as to fix an intraocular implant in the eye or the problem that the installed intraocular implant moves, and that it has such an advantage that there is no need to make the incision for operation large.

[0003] For injecting a filler into the lenticular capsule, at first, the lenticular capsule front is incised to form a predetermined incision in it, and the contents of the

crystalline lens cloudy due to cataract, etc. such as nuclei, cortical substance and epithelial cells are sucked and removed through the incision in the lenticular capsule front, to leave the lenticular capsule front. Subsequently, a filler is injected through the incision. However, while the filler is being injected or after the filler has been injected, the filler flows out through the incision of the lenticular capsule front.

[0004] Therefore, various measures have been being taken to prevent the filler from flowing out of the capsule. For example, in the "Ocular Surgery News", Vol. 14, No. 20, p. 38-39 (October 15, 1996), etc., proposed was a lenticular capsule plug consisting of a plug member to be installed at the incision in the lenticular capsule and a tube to be inserted through the plug member. A predetermined filler is injected into the capsule, and after completion of injection, the tube is cut off so as not to remain in the eye, while the incision is closed by the plug member, to prevent the filler from flowing out of the incision.

[0005] However, the conventional lenticular capsule front plug having a structure that the tube is inserted through the plug member formed like a disc, with the tube kept just about vertical to or slightly inclined against the plug member has such problems that when the lenticular capsule front plug is inserted into the eye and installed at the incision of the capsule front, it loads to the ophthalmic tissue, the tube and the plug member, to damage the ophthalmic tissue, and that the incision cannot be sufficiently closed because of the deformation of the plug member, and that it becomes difficult to inject the filler through the tube.

Especially, since the filler is injected, with the needle of an injector inserted through the hollow portion of the tube, the tube bent by said load makes the filler injection work very difficult.

[0006]

[Problems to be solved] The present invention has been completed in order to solve the above problems. A main task is to provide a lenticular capsule front plug designed so as not to load to the ophthalmic tissue, the tube or the plug member when it is inserted into the eye or installed at the incision of the lenticular capsule front, to solve all the problems caused by such loading. Another task is to provide a lenticular capsule front plug for enabling a filler to be injected easily without allowing the tube to be bent when the lenticular capsule front plug is inserted into the eye.

[0007]

[Solving means] The gist of the present invention to solve the above problems is a lenticular capsule front plug, which consists of a tube for injecting a light-transmittable filler into a lenticular capsule emptied by taking out the contents from an incision formed in the lenticular capsule front, and a plug member to be fixed to the tube, with the tip portion of the tube inserted through the plug member, and to be fitted in the incision in order to close the incision, characterized in that the tube is inserted through and fixed in the plug member, with the tube kept inclined against the reference plane of the plug member at an angle of 1 to 45 degrees.

[0008] As described above, in case of the lenticular capsule front plug of the present invention, the tube is kept inclined at a very small angle of 45 degrees or less against the plug member very unlike the installation angle of the conventional tube. Thus, the lenticular capsule front plug which is generally inserted into the eye through an incision formed in a predetermined region of the sclera existing around the cornea can be effectively fitted to the incision formed in the front region of the lenticular capsule. Therefore, it does not happen that even if the lenticular capsule front plug is fitted in the incision of the capsule front, a load(s) acts on the circumferential portion of the incision, to adversely affect the ophthalmic tissue. Furthermore, it does not happen that the incision closing structure is adversely affected by any load to the plug member. Moreover, the tube is not bent, and hence the problem that the operation of injecting a filler through the tube is adversely affected can be effectively solved.

[0009] According to a preferable embodiment of the lenticular capsule front plug of the present invention, a checking means for preventing the back flow of the filler injected through the hollow portion of the tube, in order to prevent the filler from flowing out is provided in the hollow portion of the tube, to effectively prevent that the filler flows out through the hollow portion of the tube.

[0010] Besides, according to another preferable embodiment of the lenticular capsule front plug of the present invention, a protrusion extending sideways is provided integrally on the peripheral portion of the plug

member, so that the plug member may be fitted in the incision while being guided by the protrusion. The presence of the protrusion enables the lenticular capsule front plug to be easily inserted through and installed at the incision and is also effective for preventing that the plug member comes out of the incision, and the plug member can be firmly fixed to the capsule.

[0011] Moreover, according to a further preferable embodiment of the lenticular capsule front plug of the present invention, a circumferential groove opened sideways is formed around the full circumference on the peripheral portion of the plug member, so that the circumferential portion of the incision can be fitted in the circumferential groove, for installing the plug member. By the presence of the circumferential groove, the plug member can be fixed to the capsule.

[0012] In case of the lenticular capsule front plug of the present invention, preferably a protrusion extending sideways is provided integrally on the peripheral portion of the plug member, and a circumferential groove opened sideways is formed around the full circumference on the peripheral portion of the plug member, in such a manner that the protrusion is positioned on the tube tip side based on the circumferential groove, so that when the plug member is installed, the circumferential portion of the incision may be fitted in the circumferential groove and so that the protrusion may be positioned in the lenticular capsule. By adopting this constitution, the plug member can be further firmly fixed to the capsule.

[0013] In case of the lenticular capsule front plug of the present invention, preferably the peripheral portions of the plug member existing on both sides of the circumferential groove in the through direction of the tube are formed in such a manner that the peripheral portion on the tube tip side has a larger flat area than that of the peripheral portion on the tube base side. In this case, if the larger peripheral portion on the tube tip side is inserted through the incision of the capsule front into the capsule and positioned there, the plug member can be effectively fixed, and the plug member can be further effectively installed to the lenticular capsule.

[0014] It is desirable that the protrusion is shifted by a certain angle, with the tube-through portion of the plug member made into the center, based on the tube extending direction on the projected plan view, and that the shifting angle is in a range of 60 to 120 degrees in view of the easiness in inserting the plug member and no influence on the optical region.

[0015] Preferably, the circumferential groove is formed to have a V structure, and in this case, the plug member can be fixed to the circumferential portion of the incision more advantageously.

[0016] In case of the lenticular capsule front plug of the present invention, it is desirable that the plug member is made of a soft material, because the lenticular capsule front plug (plug member) can be more easily inserted into the eye.

[0017] In addition, in the present invention, the plug member can consist of two sheets with a gel provided between

the sheets. If the tube is inserted through and fixed in the two sheets at an inclination angle specified in the present invention, the lenticular capsule front plug of the present invention can be formed.

[0018] Besides, in the present invention, the protrusion extending sideways is integrally provided on the peripheral portion of the sheet positioned on the tube tip side, out of the two sheets constituting the plug member, so that when the plug member is installed, the sheet having the protrusion may be positioned in the lenticular capsule.

[0019] [Embodiments of the invention] The present invention is described below in more detail based on drawings.

[0020] At first, Figs. 1 (a) and (b) show an example of the lenticular capsule front plug of the present invention. In the drawings, a lenticular capsule front plug 10 is formed by integrally assembling a tube 12 with a predetermined length and a disc-like plug member 14. In case of the lenticular capsule front plug 10 constituted like this, the tube 12 functions as a guide for inserting the needle of an injector for injecting a predetermined filler into the lenticular capsule, and the predetermined filler can be injected through the needle of an injector inserted through the hollow portion of the tube 12, into the lenticular capsule emptied by taking out the contents such as nuclei, cortical substance and epithelial cells of the crystalline lens through an incision formed in the lenticular capsule front.

After completion of the injection, the tube 12 is discontinued from the plug member 14, so that the tube 12 is kept away

from contact with the endothelium of the cornea and the iris. The plug member 14 is fitted in the incision to close the incision formed in the lenticular capsule front, and while the filler is being injected and after the filler has been injected, it functions as a plug for the incision.

[0021] Meanwhile, in case of the lenticular capsule plug 10 constituted like this, in a state where the tip portion of the tube 12 is inserted through the center of the plug member 14, and in a state where the tube 12 is inclined at a predetermined inclination angle of θ_1 against the upper surface, viz. the reference plane of the plug member 14, the tube 12 is integrally assembled and fixed with the plug member 14. In the present invention, as the inclination angle θ_1 of the tube 12 against the plug member 14, an angle of 1 to 45 degrees, preferably 10 to 35 degrees is adopted, and in this case, when the lenticular capsule front plug 10 is inserted into the eye, no load acts on the ophthalmic tissue, the tube 12 or the plug member 14, to solve the problems caused by such loading, and the tube 12 is not bent, to enable the filler injecting work to be done very easily. If the inclination angle θ_1 is larger than 45 degrees so that the tube 12 is kept vertical or inclined just about vertically to the plug member 14, a large load acts on the ophthalmic tissue, the tube 12 and the plug member 14 when the lenticular capsule front plug is inserted into the eye, and furthermore, the tube 12 is bent, to make the filler injecting work difficult.

[0022] Moreover, the hollow portion of the tube 12 is packed with a gelled material 16, to form a gel plug as a

checking means. Namely, the gelled material 16 packed in the hollow portion of the tube 12 is a silicone gel or acrylic gel, etc., and it allows the needle of the injector for injecting the filler to be inserted through, and on the other hand, the space between the needle and the inner surface of the hollow portion is packed with it, to prevent the injected filler from leaking (flowing out). Moreover, after the needle of the injector has been removed, the gelled material 16 closes the hollow portion of the tube 12, to exhibit a plug function, and the injected is prevented from flowing out. In this sence, it is desirable that the gelled substance 16 is supplied so as to exist at least in the hollow portion of the tube 12 at a position at which the tube 12 is inserted through the plug member 14.

[0023] It is preferable that the tube 12 is soft (flexible) because it can be easily inserted into the eye, but the material of the tube 12 can be either a soft material or a hard material and can be adequately selected from publicly known materials. If the tube 12 is made of a hard material, the tube is made thinner so as to be flexible.

[0024] On the other hand, the plug member 14 integrally fixed at the tip portion of the tube 12 is formed like a disc in this example, as can be seen from the drawings, and it consists of a large-diameter peripheral portion 14a and a small diameter peripheral portion 14b, and a V shaped circumferential groove 18 is formed between them so as to be opened sideways around the full circumference of the peripheral portion.

The tip portion of the tube 12 is inserted through and integrally fixed with the disc-like

plug member 14, as illustrated, with the large-diameter peripheral portion 14a positioned on the tube 12 tip side, in other words, in such a manner that the large-diameter peripheral portion 14a larger in the flat area than the small-diameter peripheral portion 14b is positioned on the tip side of the tube 12.

[0025] In the circumferential groove 18, the circumferential portion of the incision of the capsule front has been fitted, and the plug member 14 is fixed to the lenticular capsule. In this sense, it is desirable that the circumferential groove 18 is formed so as to have a V structure with an acute angle, and thus, the plug member can keep its strength and can be easily fitted.

[0026] The plug member 14 has the tongue-like protrusion 20 extending outwardly in the direction of the diameter, viz. sideways, integrally at the large-diameter peripheral portion 14a. By the presence of the protrusion 20, easy insertion of the plug member 14 into the capsule and easy fitting at the circumferential portion of the incision become possible, and in addition, the effect of firmly fixing the plug member 14 at the lenticular capsule, viz. the effect of preventing it from coming out can be exhibited. For exhibiting these effects, it is desirable that the protrusion 20 is formed at the large-diameter peripheral portion 14a on the tip-side of the tube 12 based on the circumferential groove 18, and it is desirable that the protrusion 20 shifts by a predetermined angle with the tube-through portion of the plug member 14 made into the center based on the extending direction of the tube 12 in the projected plan view. In view of easy insertion and

no influence on the optical region, the shifting angle θ_2 is in a range of 60 to 120 degrees on both the right and left sides based on the extending direction of the tube 12. The reasons why the angle θ_2 is 60 to 120 degrees on both the right and left sides are that the hand more skillful than the other (right or left hand) varies from user to user (doctor) and that the protrusion 20 is provided symmetrically based on the extending direction of the tube 12.

[0027] By the way, it is preferable that the plug member 14 is made of a soft material to make the insertion easier. For example, a silicone rubber or an acrylic rubber can be advantageously used, but a polyurethane, segmented polyurethane, polysiloxane-polyurethane block copolymer or graft copolymer, or elastomer such as fluorine rubber can also be advantageously used.

[0028] The plug member 14 of this example is a flat disc, but it can also have, for example, a circular arc form or spherical form without any problem. In this case, the reference flat plane of the plug member is, as shown in Fig. 2 (a), the plane where the tube 12 is inserted through the plug member 14 (tangential line), and the tube 12 is integrally assembled with the plug member 14 in such a manner that the tube 12 is inclined at a predetermined angle of θ_1 on the plane.

[0029] In case of the lenticular capsule-front plug 10 of the above example, the hollow portion of the tube 12 is packed with a gelled material 16, to prevent the back flow of the injected filler, as a gel plug provided as a checking means for preventing the outflow of the filler. However, instead of

it, any of various publicly-known check valves such as an umbrella type valve or a duck-bill type valve can be installed for the tube 12. In this case, the check valve 22 can be provided in the hollow portion of the tube 12 as shown in Fig. 2 (b), or on the tip of the tube 12 as shown in Fig. 2 (c). Anyway, any other checking means than the gel plug and the check valves described above can also be used, as far as it allows the injection of the filler through the hollow portion of the tube 12 but can prevent the outward flow (leak) of the injected filler. The gelled material 16 used as the gel plug can be any of various publicly-known materials, and, for example, it can be adequately selected from the gelled materials stated in Japanese Patent Laid-Open No. 1992-224746.

[0030] In case of the lenticular capsule front plug 10 of the above example, the tube 12 and the plug member 14 are formed as separate parts, but they can also be provided as an integral part made of the same material without any problem.

[0031] Moreover, in the present invention, a lenticular capsule front plug 10 with such a structure as shown in Figs. 3 (a) and (b) can also be advantageously used. In this example, the plug member 14 of the lenticular capsule front plug 10 consists of a small diameter disc-like top sheet 24 with a small flat area, a large-diameter disc-like bottom sheet 26 with an area larger than that of the top sheet, and a gelled material 28 provided between the sheets 24 and 26.

Through the top and bottom sheets 24 and 26, the tip portion of the tube 12 is fixed at a predetermined inclination angle of θ_1. On the peripheral portion of the bottom sheet 26 of

the plug member 14, the tongue-like protrusion 20 extending outwardly in the diameter direction, viz. sideways, is formed integrally on the side opposite to that shown in Fig. 1 at a predetermined shifting angle of θ_2.

[0032] By the way, to set the lenticular capsule front plug 10 of the present invention into the lenticular capsule, as shown in Fig. 4 (a), through the incision provided in a predetermined region of the sclera located around the cornea, an incision 32 with a diameter of about 2 mm is formed at first in the equatorial portion of the lenticular capsule on the 12 o'clock side by insertion (e.g., Continuous Circular Capsulorhexis) without damaging the iris 30, etc. Then, as shown in Fig. 4 (b), an ultrasonic tip 34 is inserted through the incision 38 formed in the sclera region around the cornea 36 and through the incision 32 of the capsule front; and the contents 42, concretely, the nuclei, cortical substance, epithelial cells, etc. of the crystalline lens are sucked and removed by ultrasonic action, leaving the lenticular capsule 40. Thus, as shown in Fig. 4 (c), the emptied lenticular capsule 40 only remains.

[0033] Then, as shown in Fig. 4 (d), the lenticular capsule front plug 10 of the present invention is inserted from the incision of the cornea 36, with the plug member 14 put ahead (forward), and furthermore, it is fitted in the incision 32 formed at the front of the lenticular capsule 40.

In connection with the insertion of the lenticular capsule front plug, if the protrusion 20 is formed on the plug member 14 of the lenticular capsule front plug 10, the protrusion 20 is at first inserted through the incision

32, and the plug member 14 is rotated pivotally through the incision 32. As a result, the large diameter peripheral portion at the tip of the plug member 14 is positioned in the capsule, and the circumferential portion of the incision 32 fits into the circumferential groove 18, to completely close the incision 32 by the plug member 14. In this case, the lenticular capsule plug 10 of the present invention inserted from the incision 38 of the cornea is set in a natural way because the tube 12 is inclined against the plug member 14 at an angle θ, of 45 degrees or less, and large load(s) or stress is not caused.

[0034] On the contrary, as shown in Fig. 5, in case of a lenticular capsule front plug 10' in which a tube 12' is provided against a plug member 14' at an angle of just about 90 degrees, if the plug member 14' is installed at the incision 32' of the lenticular capsule 40', the capsule tissue around the incision, the plug member 14' and the tube 12' are loaded or stressed. Besides, since the tube 12' is bent, the tissue around the incision 38' of the cornea 36' is also loaded or stressed.

[0035] After the lenticular capsule front plug of the present invention has been set to the incision 32 of the lenticular capsule 40, as shown in Fig. 4 (e), the needle 46 of an injector 44 for injecting a predetermined filler is inserted through the hollow portion of the tube 12 of the lenticular capsule front plug 10, and the filler 48 is injected from the injector 44, to fill the lenticular capsule 40 with the filler 48. Furthermore, after the filler 48 has been injected, the needle 46 of the injector

48 is pulled from the tube 12, and the tube 12 is cut as short as possible without allowing the tube 12 to come into contact with the endothelium of the cornea 36, the iris 30, etc., and on the other hand, the incision 38 of the cornea is sutured, to complete the operation in such a state as shown in Fig. 4 (f).

[0036] The filler 48 to be injected into the lenticular capsule 40 from the injection 44 can be any publicly-known material as far as it is a light-transmittable material, and it can be selected, for example, from silicone gels, collagen gels, hydrogels, elastomers, soft rubbers, etc., and the fillers stated in Japanese Patent Laid-Open Nos. 1988-20075 and 1992-224746, etc. can also be similarly used.

[0037] Typical examples of the lenticular capsule front plugs of the present invention have been described in detail, but needless to say, the present invention is not limited thereto or thereby. Moreover, it should be understood that the present invention can be modified or improved variously based on the knowledge of persons skilled in the art within the scope of the present invention.

[0038]

[Examples] Some examples of the present invention are described below to clarify the excellent effects of the present invention.

[0039] Example 1

At first, a lenticular capsule front plug (10) with such a structure as shown in Fig. 1 was prepared. As the tube (12), a silicone tube was used, and it was installed to a disc-like silicone plug member (14) at an inclination angle θ_1 of 30 degrees. The plug member (14) had a

circumferential groove (18) with an acute angle of 45 degrees formed between a large-diameter peripheral portion (14a) and a small-diameter peripheral portion (14b), and a tongue-like protrusion (20) was provided at an angle θ_2 of 90 degrees based on the extending direction of the tube (12). Besides, a check valve was provided as a checking means in the tube (12).

[0040] The lenticular capsule front of an eye of a house rabbit was incised, and through the formed incision, the contents (nuclei, cortical substance, epithelial cells, etc.) of the crystalline lens were sucked and removed. Then, the lenticular capsule front plug (10) was inserted into and installed at the incision of the capsule front. The lenticular capsule front plug could be easily inserted and installed.

[0041] Then, the needle of an injector was inserted through the tube (12) of the lenticular capsule front plug (10), and a predetermined filler (silicone sol) was injected into the capsule. The filling of the filler was easy, and the filler did not leak. Besides, after the filler had been completely injected, the needle of the injector was pulled, and the tube (12) was cut near the plug member (14). After completion of the operation, the eye of the house rabbit was observed, and it was found that the lenticular capsule front plug (10) had been fixed in the capsule and that the silicone sol became a gel due to the crosslinking polymerization, etc. caused by the body temperature, and any leak of the filler was not observed.

[0042] Example 2

An eye of a house rabbit was operated as described for Example 1, except that the inclination angle of the tube (12) to the plug member (14) was 15 degrees. The results were as obtained in Example 1.

[0043] Example 3

An eye of a house rabbit was operated as described for Example 1, except that a lenticular capsule front plug (10) with such a structure as shown in Fig. 3 was used. The two sheets (24 and 26) constituting the plug member (14) were silicone sheets, and as the gelled material (28) to be provided between the two sheets, a silicone gel was used. Furthermore, as the check means, a silicone gel (16) was packed in the tube (12), to form a gel plug. The results were as obtained in Example 1.

[0044] Comparative Example 1

An eye of a house rabbit was operated as described for Example 1, except that the angle θ_1 between the tube (12) and the plug member (14) was 90 degrees. It was difficult to insert and install the lenticular capsule front plug. Furthermore, it was also difficult to inject the filler, and the leak of the filler was observed.

[0045]

[Effects of the invention] As can be seen from the above description, in case of the lenticular capsule front plug of the present invention, since the tube is installed at an inclination angle of 1 to 45 degrees against the plug member, it can be effectively prevented that the ophthalmic tissue, the tube and the plug member are loaded when and after the lenticular capsule front plug is inserted, and in

addition, because the tube is bent when it is inserted into the eye, the filler can be easily injected.

[0046] Moreover, if a protrusion is formed at the plug member of the lenticular capsule front plug of the present invention, the lenticular capsule front plug can be easily inserted into the lenticular capsule, and in addition, it can be firmly fixed to the capsule, thus effectively preventing that the plug member comes out. Furthermore, if a circumferential groove is formed around the peripheral portion of the plug member, the plug member consists of two sheets and a gel provided between them, the lenticular capsule front plug can be effectively fixed to the lenticular capsule.

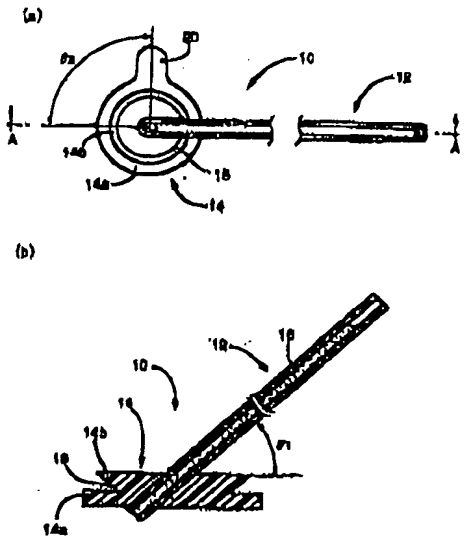
[Brief description of the drawings]

[Figs. 1] Shows an example of the lenticular capsule front plug of the present invention; (a) is a plan view, and (b) is a cross-sectional view taken along A-A in (a).

[Figs. 2] Shows another example ~~example~~ of the lenticular capsule front plug of the present invention; (a) is an illustration showing the inclination angle of the tube in the event that the plug member has been curved, and (b) and (c) are cross-sectional views showing different check valves to be provided for the tube.

[Figs. 3] Shows a further example of the lenticular capsule front plug of the present invention; (a) is a plan view, and (b) is a cross-sectional view taken along B-B in (a).

【図1】



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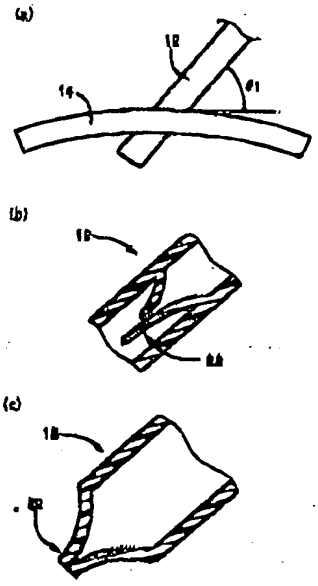

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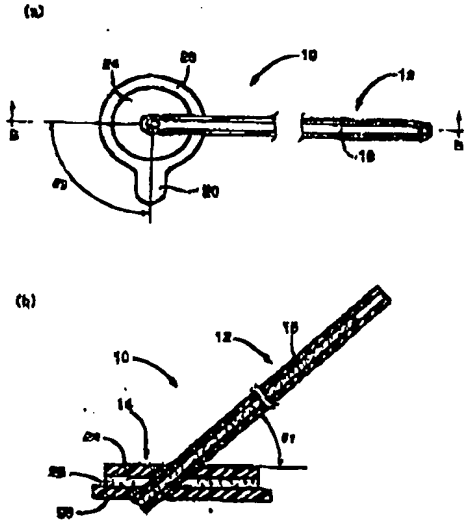

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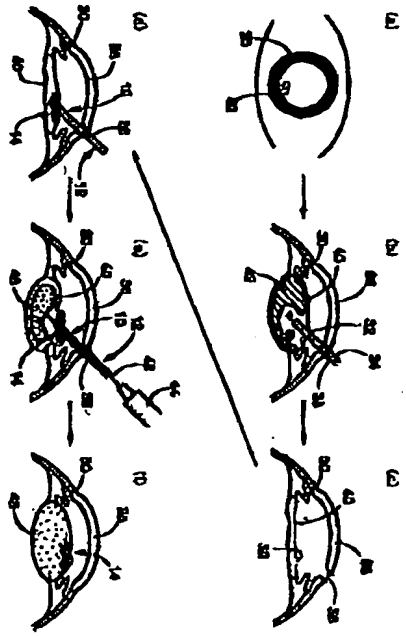
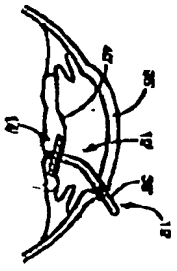


【図5】



[Figs. 4] A process illustration showing an example of the operation method for using the lenticular capsule front plug of the present invention.

[Fig. 5] An illustration showing a state where a conventional lenticular capsule front plug is installed, and corresponding to Fig. 4 (b).

[Meanings of symbols]

10	lenticular capsule front plug	12	tube
14	plug member	16, 28	gelled material
18	circumferential groove	20	protrusion
22	check valve	24	top sheet
26	bottom sheet	30	iris
32	incision	34	ultrasonic tip
36	cornea	38	incision
40	lenticular capsule	42	contents of crystalline lens
44	injector	46	needle
48	filler		